

CLAIMS

What is claimed is:

1. A photolithographic process sequence for manufacturing MEMS structures from a first material layer of a first-material-layer thickness disposed over and in contact with a second material layer, the sequence comprising:
  - a. forming a mask over the first material layer, wherein the mask leaves portions of the first material layer exposed;
  - b. etching the first material layer in the exposed portions to a first depth less than the first-material-layer thickness, wherein the masked portions form a raised pattern defined by recessed areas formed in the exposed portions;
  - c. removing at least a portion of the mask, leaving at least a portion of the raised pattern and the recessed areas exposed; and
  - d. etching the exposed raised pattern and recessed areas of the first material layer until the second material layer is exposed in the recessed areas, leaving the pattern affixed to the second material layer.
2. The method of claim 1, wherein the pattern comprises first and second portions and wherein forming the mask comprises:
  - a. forming a first sub-mask defining the first portion of the pattern; and
  - b. forming a second sub-mask defining the second

portion of the pattern.

3. The method of claim 1, wherein removing at least a portion of the mask comprises removing the second sub-mask.
4. The method of claim 3, wherein the second sub-mask comprises photoresist.
5. The method of claim 1, further adapted to manufacture a second collection of MEMS structures from a third material layer of a third-material-layer thickness, the sequence further comprising:
  - a. forming a second mask over the third material layer, wherein the second mask leaves portions of the third material layer exposed;
  - b. etching the third material layer in the exposed portions of the third material layer to a second depth less than the third-material-layer thickness, wherein the masked portions of the third material layer form a second raised pattern defined by recessed areas formed in the exposed portions of the third material layer;
  - c. removing at least a portion of the second mask, leaving at least a portion of the second raised pattern and the recessed areas in the third material layer exposed; and
  - d. etching the exposed second raised pattern and recessed areas in the third material layer to remove the material in the recessed areas of the third material layer.

6. The method of claim 5, wherein substantially all of the material in the recessed areas of the third material layer is removed.
7. The method of claim 5, wherein the second material layer is disposed between the first material layer and the third material layer.
8. A photolithographic method of patterning a first material layer over a second material layer, the first material layer being of a thickness and having a first surface in contact with the second material layer and a second surface, the method comprising:
  - a. forming a mask over the second surface of the first material layer, wherein the mask leaves portions of the second surface exposed;
  - b. etching the first material layer in the exposed portions to a first depth less than the thickness of the first material layer, wherein the masked portions form a raised pattern defined by recessed areas formed in the exposed portions;
  - c. removing the mask, leaving the raised pattern and the recessed areas exposed; and
  - d. etching the raised pattern and recessed areas of the first material layer until the second material layer is exposed in the recessed areas, leaving the pattern affixed to the second material layer.
9. The method of claim 8, wherein the first material

layer comprises a semiconductor.

10. The method of claim 9, wherein the second material layer comprises an insulator.
11. The method of claim 8, wherein the first material layer comprises a semiconductor, and wherein the second material layer comprises an insulator.
12. The method of claim 8, wherein the mask comprises a semiconductor.
13. The method of claim 8, wherein at least one of the etchings are accomplished using a reactive ion etch process.
14. A micro-machining method for patterning a first material layer over a second material layer, the first material layer being of a thickness and having a first surface in contact with the second material layer and a second surface, the method comprising:
  - a. forming a first mask over the second surface of the first material layer, wherein the first mask leaves portions of the second surface exposed;
  - b. etching the first material layer in the exposed portions to a first depth less than the thickness of the first material layer, wherein the masked portions form a raised pattern defined by recessed areas formed in the exposed portions;
  - c. forming a second mask over a first portion of the raised pattern, leaving a second portion of the

raised pattern and the recessed areas exposed;  
and

- d. etching the second portion of the raised pattern and recessed areas of the first material layer until the second material layer is exposed in the recessed areas, leaving the pattern affixed to the second material layer, wherein the second mask protects the first portion of the raised pattern from the etching of (d), leaving the second portion of the raised pattern thinner than the first portion of the raised pattern.
15. The method of claim 14, wherein the second mask comprises at least a portion of the first mask.
  16. The method of claim 14, wherein the first mask comprises photoresist.
  17. The method of claim 14, wherein the first material layer comprises a semiconductor and the second material layer comprises an insulator.
  18. The method of claim 14, further comprising removing at least a portion of the second material layer.